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Sol-gel Based Fiber Optic pH Sensor

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Every year, 550,000 new cases of stroke are reported in the United States resulting in 150,000 deaths while leaving 300,000 survivors disabled. According to the American Heart Association, rapid intervention may help lower the number of deaths and disabilities. At LLNL, we are developing tools, such as laser thrombolysis and microtools (MEMS) to treat stroke. Fiber optic pH sensors would be part of an arsenal to quickly and aggressively treat people undergoing a "brain attack". These sensors are being developed for a novel application, in that they will be coaxially threaded through a catheter beyond an occlusion in the vascular system. The fiber optic sensor would provide fast, local measurements of tissue viability, hence providing an assessment on the patient's status and allowing an optimal treatment plan to be quickly implemented which may help lower the mortality and morbidity rates.

We report here on the development of a sol-gel based fiber optic sensor to monitor local blood pH. The fiber optic pH sensor design was based on the immobilization of a pH sensitive dye, seminaphthorhodamine-1 carboxylate (SNARF-1C), onto the tip or surface of an optical fiber using the sol-gel method. The fiber optic pH sensor was tested in phosphate buffered saline, human plasma, and human whole blood using a bench-top spectrofluorimeter system. Linear responses were shown in blood in the pH range 6.8 to 8.0 indicating possible use for in vivo sensing. Bulk sol-gel samples were also examined in a spectrofluorimeter to determine if encapsulation was possible without leaching or interference of the pH sensitive dye molecule. Encapsulation of SNARF-1C within the sol-gel matrix proved to be successful in that minimal amount of leaching and interference was observed.

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